MOSQUITO CONTROL IN NORTH CAROLINA

Overview

There is no vaccine or medication to prevent or treat Zika virus infections. Follow the summary guidelines below in order to help prevent transmission. While Zika virus is a very concerning issue right now, and the emphasis of this paper is on Zika and its (potential) vectors, there are approximately 60 species of mosquitoes present in NC and each has unique ecological and biological characteristics (e.g., different larval habitat, blood feeding behaviors, biting activities, and distributions) that may require a variety of thoughtful prevention and control measures to reduce disease. Some mosquito species are common and are likely distributed throughout the state while others may be found only in large abundance near the coast. To illustrate the different types of mosquitoes found in NC, here is a brief list of some of the species that are of public health concern:

Culex pipiens* & *Culex quinquefasciatus
Common Name(s): Northern house mosquito & Southern house mosquito *Pronunciation:* Cue-lex pip-e-ens & Cue-lex kwink-uh-fas-e-ah-tus *Biting Activity:* Crepuscular and nocturnal *Geographic Distribution:* Believed to be statewide Larval *"Breeding" Locations:* Storm sewer catch basins, ground pools, ditches, other high organic sites *Associated Disease(s):* West Nile Disease *ULV Adulticiding Effective:* Yes, when applied by a knowledgeable professional
Culiseta melanura
Common Name(s): Black tailed mosquito *Pronunciation:* Cue-la-see-ta mel-uh-nur-uh *Biting Activity:* Nocturnal, perhaps crepuscular (twilight) *Geographic Distribution:* Most abundant in the coastal plains, but also found in piedmont and foothills Larval *"Breeding" Locations:* Cryptic and subterranean habitats in freshwater swamp complexes *Associated Disease(s):* Eastern Equine Encephalitis *ULV Adulticiding Effective:* Yes, when applied by a knowledgeable professional
Aedes albopictus
Common Name(s): Asian tiger mosquito *Pronunciation:* Aye-dees al-bow-pic-tus *Biting Activity:* Diurnal and crepuscular *Geographic Distribution:* Believed to be statewide *Larval "Breeding" Locations:* Man-made and natural containers are ideal habitats *Associated Disease(s):* Potentially Chikungunya, Dengue, La Crosse Encephalitis, and Zika *ULV Adulticiding Effective:* Not effectively controlled by standard nighttime ULV applications.
Aedes triseriatus
Common Name(s): Eastern treehole mosquito *Pronunciation:* Aye-dees try-seer-e-ay-tuss *Biting Activity:* Diurnal and crepuscular *Geographic Distribution:* Believed to be statewide *Larval "Breeding" Locations:* Man-made and natural containers are ideal habitats *Associated Disease(s):* La Crosse Encephalitis *ULV Adulticiding Effective:* Not effectively controlled by standard nighttime ULV applications.

Aedes sollicitans
Common Name(s): Eastern saltmarsh mosquito *Pronunciation:* Aye-dees soul-liss-uh-tans *Biting Activity:* Crepuscular (peak activity); will readily bite at other times if host nearby *Geographic Distribution:* Coastal *Larval "Breeding" Locations:* Coastal saltmarshes *Associated Disease(s):* Potential epidemic vector for Eastern Equine Encephalitis, primarily a nuisance mosquito *ULV Adulticiding Effective:* Yes, when applied by a knowledgeable professional; aerial spray missions are often required post hurricane
Aedes taeniorhynchus
Common Name(s): Black saltmarsh mosquito *Pronunciation:* Aye-dees tee-knee-oh-rink-us *Biting Activity:* Crepuscular (peak activity); will readily bite at other times if host nearby *Geographic Distribution:* Coastal *Larval "Breeding" Locations:* Coastal saltmarshes *Associated Disease(s):* Primarily a nuisance mosquito *ULV Adulticiding Effective:* Yes, when applied by a knowledgeable professional; aerial spray missions are often required post hurricane

Crepuscular: twilight, Diurnal: daytime, Nocturnal: nighttime, ULV: ultra-low volume

Personal Protection Messages

- Wear insect repellent: It is important to use insect repellent as directed by the product label instructions. It is the BEST way to protect yourself from mosquito bites. Pregnant women and children should use insect repellent as well. Do not put repellents on infants younger than 2 months of age. Protect infants from mosquito bites by using netting properly draped over a carrier with a tight fit along the edges.
    - DEET: Products containing DEET include Cutter, OFF!, and Skintastic. Concentrations of DEET in these products vary. In general, the concentration of DEET in a product indicates how long the product will be effective. Therefore, products containing lower concentrations may need to be reapplied depending on the length of time the person is outdoors.
    - Picaridin (also known as KBR 3023, Bayrepel, and icaridin): Products containing picaridin include Cutter Advanced, Skin So Soft Bug Guard Plus, and Autan outside the United States).
    - Oil of lemon eucalyptus (OLE) or PMD: Repel contains OLE. (Note: Products using OLE should not be used on children under the age of three years)
    - IR3535: Products containing IR3535 include Skin So Soft Bug Guard Plus Expedition and SkinSmart.
- When weather permits, wear long-sleeved shirts and pants.

- Use air conditioning or make sure that you repair and use window/door screens.

- When traveling, look for country-specific guidance on mosquito protection.

- The Communicable Disease Branch continues to work with mosquito experts at state universities to formulate mosquito surveys, surveillance and control training sessions for selected local health departments.

Homeowner Control

- "Tip and Toss": Make sure that standing water is tipped out of bird baths, flower containers, wading pools and other containers around your yard at least once every five days. Mosquitoes use containers to breed and larvae will develop in these areas.

- Store, discard, or recycle any items that can accumulate any amounts of standing water.

- Keep pools chlorinated, clean, and properly maintained. Prevent pool covers and liners from holding standing water.

- Clean gutters frequently as debris can clog and reduced water flow thus causing gutters to fill up with standing water.

- Treat standing water in ornamental ponds or water features known to have mosquito larvae with mosquito "dunks" (e.g., briquettes containing Bti). When possible, stock ornamental water features with fish that will eat mosquito larvae.

INTEGRATED MOSQUITO MANAGEMENT

Education

- Create messaging for the general public on how to best protect themselves from Zika or mosquito spread disease. Begin messaging about "tip and toss" campaigns before mosquito season. Increase messaging when larval and adult mosquitoes are active.

- Work with local health departments to communicate messages, share epidemiological and ecological data, and obtain information about travel-related or locally-transmitted mosquito spread virus disease cases in the area.

Surveillance

- Monitor the populations of potential vectors and risk of chikungunya/dengue/zika virus circulation in your area.

- Implement larval surveillance programs to determine the number, type, and distribution of containers producing *Aedes aegypti* and *Aedes albopictus*.

Source reduction

- Reduce mosquito densities by removing larval habitats.

- Remove discarded, unused, and unmaintained containers through community involvement programs or by vector control personnel. Containers are ideal larval habitats for potential Zika vectors.

Larval control

- When source reduction is not feasible, apply biological or chemical larvicides to potential larval habitats. The application of larvicides must be made by a knowledgeable and licensed applicator pursuant to licensing and certification regulations administered and enforced by the NC Department of Agriculture & Consumer Services. See link for additional details: http://www.ncagr.gov/SPCAP/pesticides/index.htm

- Use larvicides registered by EPA for application to containers.

- It is critical to have surveillance programs in place to understand and document the effectiveness of mosquito control.

Adult mosquito control (mosquito spraying)
This would generally be used only in outbreak situations.

- *Aedes aegypti* and *Aedes albopictus* are most active during the day and early crepuscular periods and are not effectively controlled by standard night-time ultra-low volume (ULV) applications. Any historic spraying programs will most likely not address the *Ae. aegypti* or *Ae. albopictus* mosquitoes using their standard and historical practices for truck-based ULV applications. Virtually all programs in existence in NC have been built to address vectors of WNV and EEE which are primarily late crepuscular and nocturnal vectors.

- If case residences or areas of local transmission can be rapidly identified, a space spray or barrier applications to individual residences **may** be warranted to further reduce the likelihood of vectors feeding on infectious people. Adulticide applications must be administered by knowledgeable and licensed professionals pursuant to NC Pesticide Law and regulations.

- It is critical to have surveillance programs in place to understand the risk for disease and the effectiveness of mosquito control. Similarly, the effectiveness of any control measure should be documented, ideally with pre- and post-intervention entomologic measures.

Resistance monitoring

- Evaluation of pesticide susceptibility in local populations of potential chikungunya, dengue, or Zika virus vectors should be performed in advance to ensure that the emergency control measures will be effective if needed.

ZIKA VIRUS GENERAL INFORMATION

- At this time, the main risk is for people who travel to areas with active transmission.

- It is of concern that Zika virus can be spread from a pregnant woman to her unborn baby. There have been reports of a serious birth defect of the brain called microcephaly and other adverse pregnancy outcomes in babies of mothers who were infected with Zika virus while pregnant.

- The major mode of transmission is through the bite of an infective mosquito. There are limited reports of sexual transmission and blood transfusion. Zika virus can be found in blood, semen, urine and saliva.

- A large outbreak of Zika virus infections began in Brazil in 2015 and has since spread to other countries in the region.

- Only about 1 in 5 people infected with Zika virus will become sick. Among those who do get sick, Zika usually causes mild symptoms that may include rash, fever, joint pain and red eyes.

- These symptoms are similar to dengue and chikungunya, two other mosquito-borne infections that are present in the same parts of the world.